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Title: Growth, trapping and abatement of dielectric particles in PECVD systems

Author(s): Raoux S (REPRINT) ; Cheung D; Fodor M; Taylor WN; Fairbairn K
Corporate Source: APPL MAT INC, 3225 OAKMEAD VILLAGE DR, M-S 1263/SANTA
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Abstract: The growth of solid residues within **PECVD** (plasma enhanced chemical vapour deposition) reactors has been extensively studied because of its implications for wafer particle contamination and is often referred to as dusty plasmas. On dielectric CVD (DCVD) production systems the **coating of chamber walls** and vacuum exhaust line with residues addresses also the issue of system maintenance. A common solution consists of periodically cleaning the deposition **chamber** by ionizing a PFC (perfluoro-compound) gas such as CF₄, NF₃ or C₂F₆. This generates free fluorine radicals that dry etch the residues deposited on **chamber walls**. However, because of limited fluorine radical lifetime, this clean process is not efficient in the vacuum exhaust line where residues accumulate.

We propose an active solution to address the issue of solid waste treatment on a production DCVD system. We review the particular case of silicon nitride deposition, which is one of the worst known processes in terms of particle generation. These considerations are also valid for silicon **oxide**, silicon oxynitride, silicon carbide and amorphous silicon deposition processes. Here we report on our investigation on the particle formation, composition and morphology within a **PECVD chamber** and the deposition of these particles on **chamber walls** and vacuum exhaust line. We describe a method to design an efficient precipitator that traps the particles immediately downstream of the deposition **chamber**. The trapping uses gravitational and electrostatic means. This system does not necessitate any disposal procedure because of its capability to perform an in situ plasma assisted clean, reactivating the effluent PFC gas from the processing **chamber**. Here, the system is referred to as downstream plasma **apparatus** (DPA).

Identifiers--KeyWord Plus(R): DUST PARTICLES; PLASMAS; DISCHARGES; DEPOSITION; TRANSPORT; CELL

Research Fronts: 95-1881 003 (DUSTY PLASMA; DOWNSHIFTED PEAK IN STIMULATED ELECTROMAGNETIC EMISSION-SPECTRUM; FINITE CHARGING TIME)
95-2029 002 (THERMOPHORETIC TRANSPORT; CU CVD; STREAMWISE CURVATURE; COPPER(II) HEXAFLUOROACETYLACETONATE; AXISYMMETRICAL MOTION)
95-0627 001 (LOW-PRESSURE INDUCTIVELY-COUPLED PLASMA; HELICON WAVE EXCITATION; MODELING OF MICROWAVE DISCHARGES)

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